ISEMP Objectives

Subbasin-scale

- Programmatic coordination, design, planning and implementation
- Indicators and metric development and testing
- Protocol development, refinement and testing.
- Sampling design development and testing
- Effectiveness and status and trend monitoring experimental design and implementation

Program-scale

- Evaluation tools development and testing
- Data management tools development and testing

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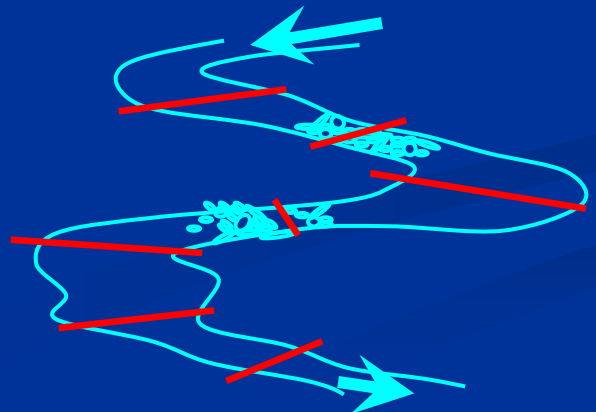
habitat monitoring protocol comparison

- compare protocols from 9 different programs
  - PIBO, AREMP, EMAP/EPA, ODFW, WDE, CDFG, R6, Wenatchee….
- make comparisons at 12 reaches – 4 step-pool, 4 pool-riffle, 4 planebed complexes
- LiDAR taken at all 12 sites
- compare to intensive survey, i.e. “truth”

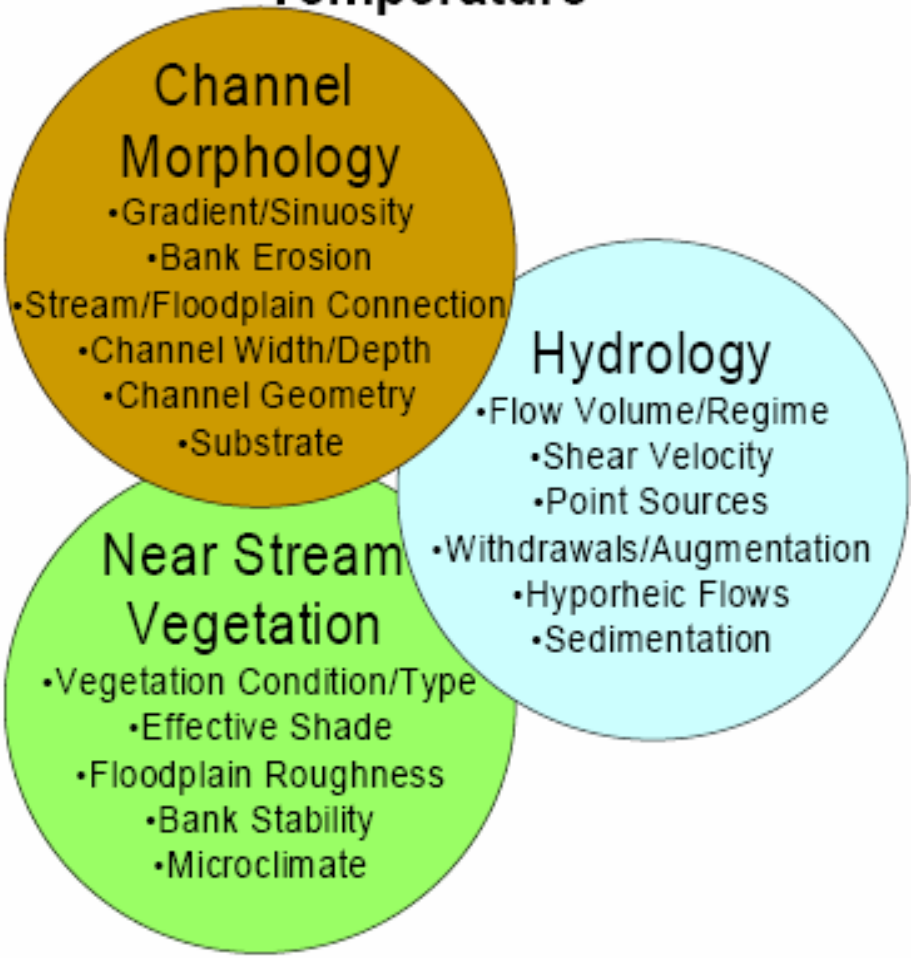


South Fork IMW
OSU/BOR

- Evaluate push-up dams as barriers to juvenile RBT movement and ultimately production

- Indexing carrying capacity of salmonids on the basis of longitudinal stream temperatures

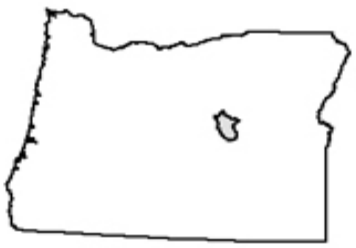
Factors that Affect Stream Temperature



(Many of these parameters are interrelated)

PIT tagged approximately 8,000 in the SFJD

Summer 2005 Study Area
South Fork John Day Basin, OR



South Fork John Day

Black Canyon Creek

12.6

13.1

15.0

19.3

17.7

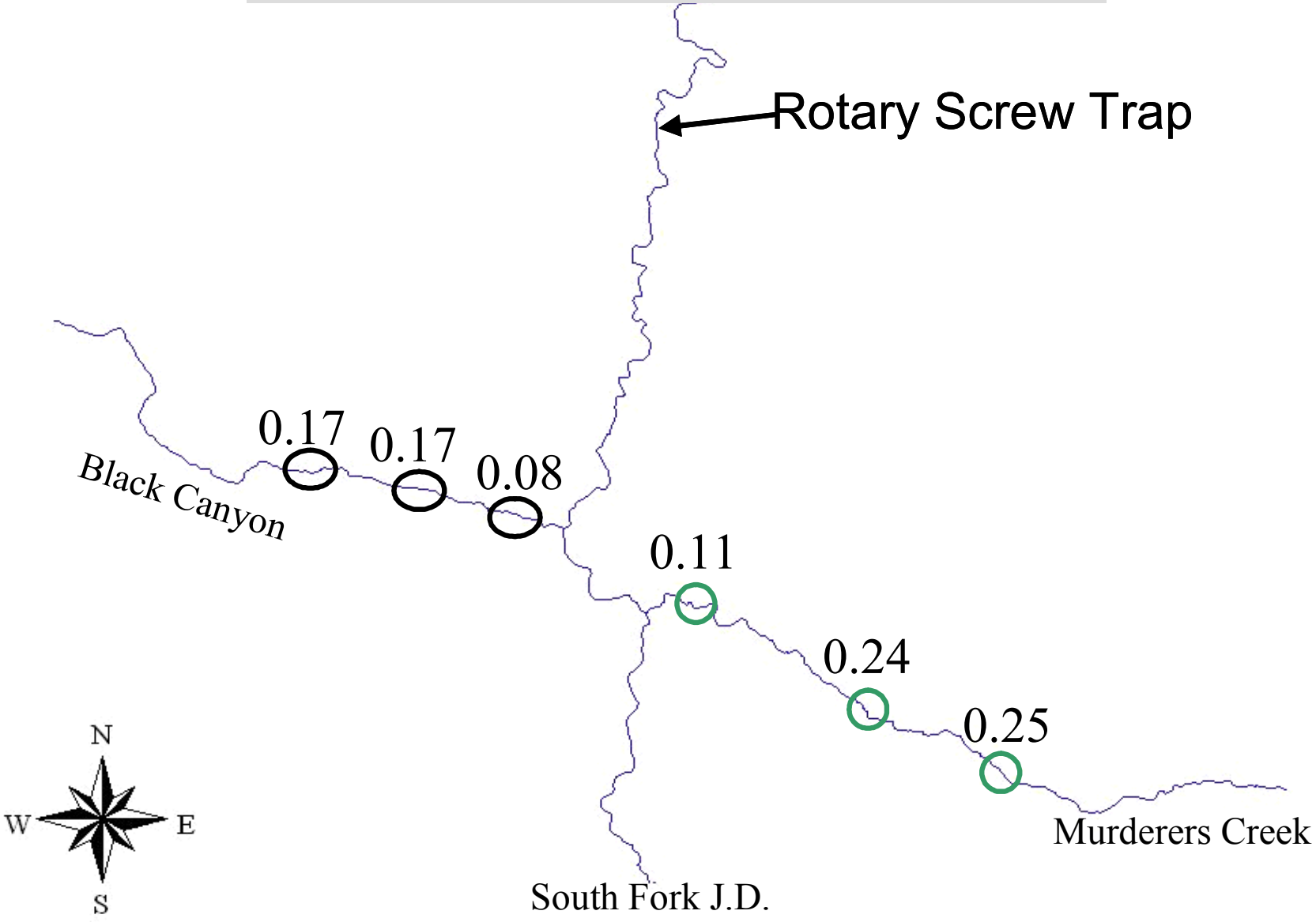
16.4

Murderers Creek

Deer Creek

13.5

Summer Growth Rates (mm/day)



A Food-Based Approach to Assessment of Habitat Quality for Drift-Feeding Salmonids

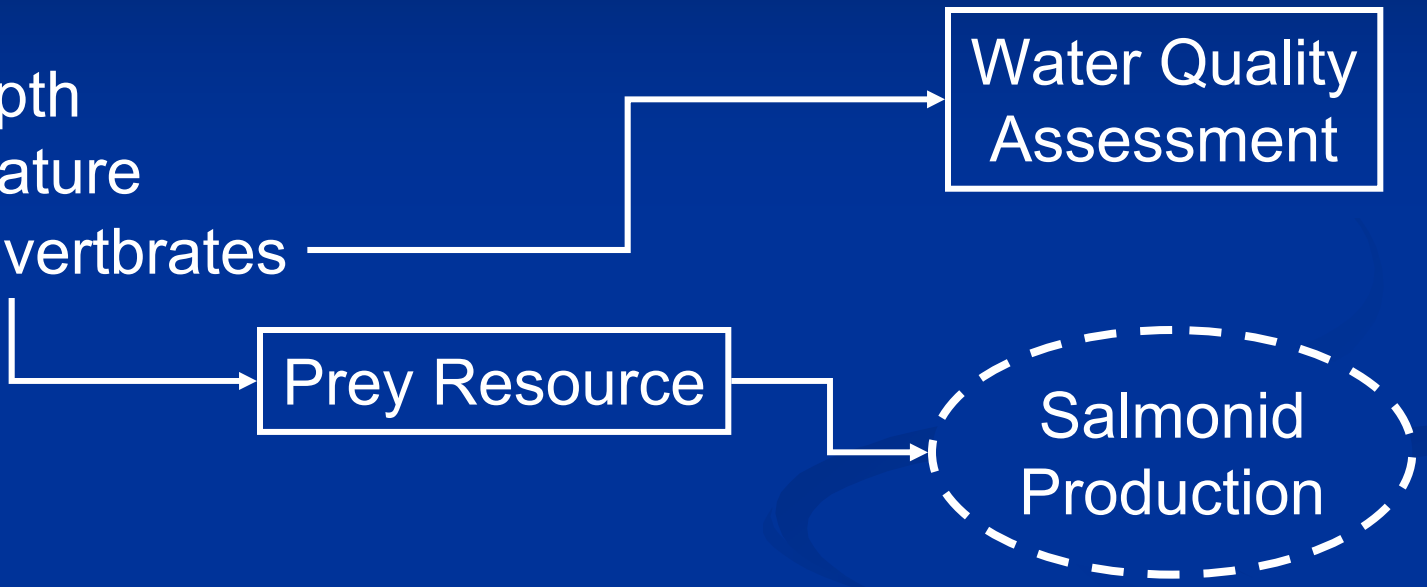
Nicholas Weber
Utah State University
Aquatic Watershed and Earth Resources

Nicolaas Bouwes
Ecological Research Inc.

Habitat Monitoring and Assessment

Commonly Monitored Habitat Attributes

- Sediment
- Cover
- Pool depth
- Temperature
- Macroinvertbrates



- Fish Production: Response many habitat factors
- Availability: Highly variable across time and space
- Cost: High cost for invert sample processing

Project Objectives

- Establish a relationship between prey resource metrics and fish production
- Evaluate sources of variability in field sample collection
- Develop cost-effective approaches to sample processing activities
- Develop a protocol that will be easily adopted into current monitoring programs

Relating prey resources to fish production

Juvenile Salmonid Production Project, OSU

Fish growth

- PIT-tag >8000 juvenile steelhead
- Estimates of fish density

Movement

- PIT-tag detectors at 2 study sites

Habitat

- Temperature, cover, LWD, depth, pool area, substrate

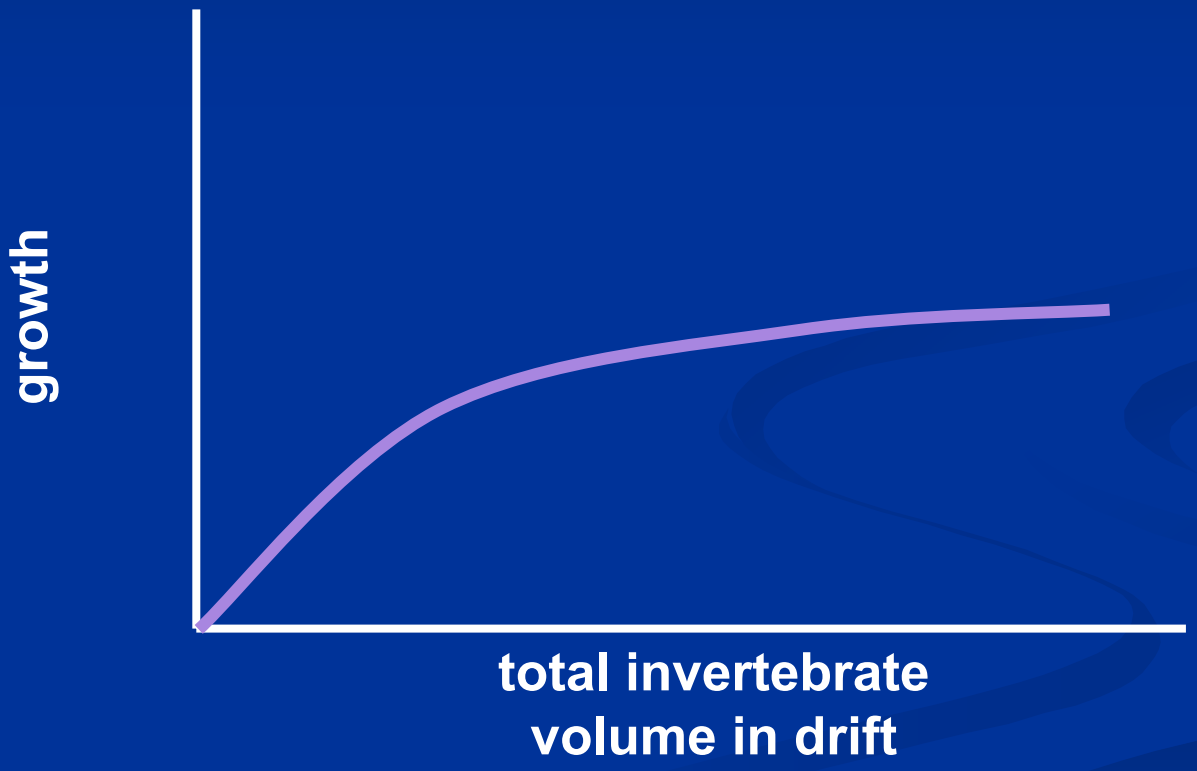
Invertebrate Production Monitoring Project

Coupled drift and benthic invertebrate samples

- > 400 samples across study area

Question: How does food affect production?

Relating prey resources to fish production



Relating prey resources to fish production

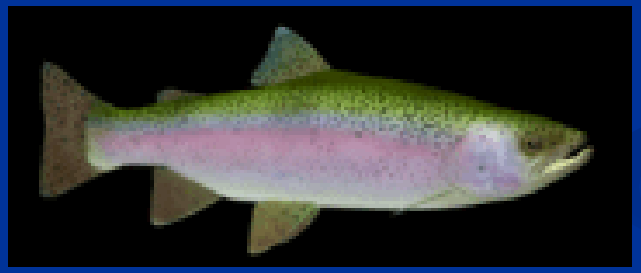
Bioenergetic Energy Budget

Growth = Consumption – (waste + metabolism)

(temp + size)

Metabolism

Waste
(output)



Growth
(field measure)

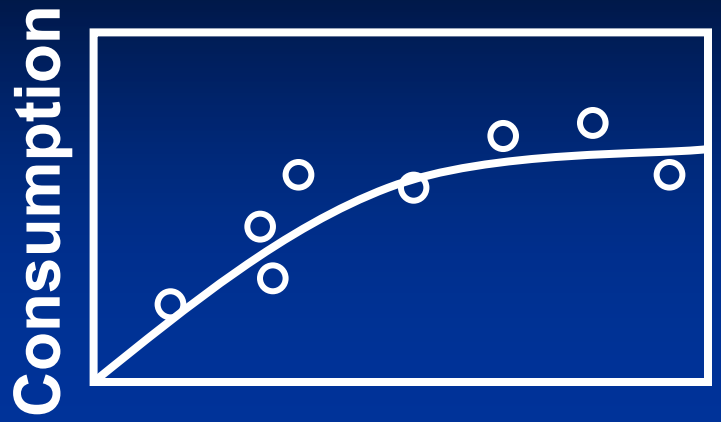
drift

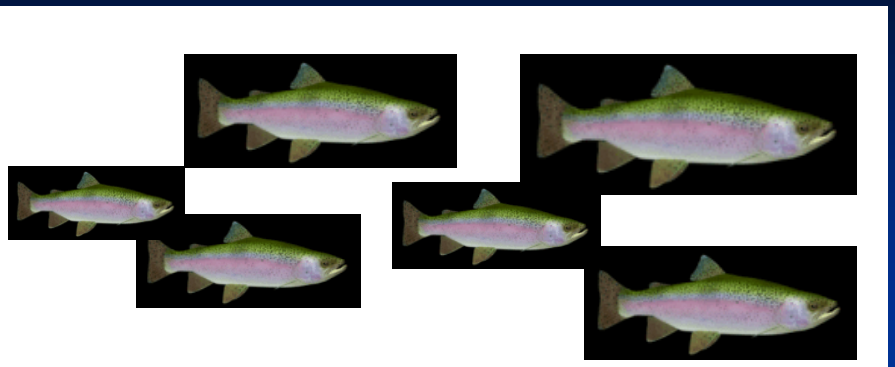
Consumption
(inputs)

terrestrials

benthic

Relating prey resources to fish production





Consumption – Bioenergetics (Waste + Metabolism) = Growth X Density

Project Objectives

- Establish a relationship between prey resource metrics and fish production

- **Evaluate sources of variability in field sample collection**

- Develop cost-effective approaches to data processing activities

Evaluating Variation

- Spatial extant for metric application
- Spatial and temporal noise affect precision
- Effort necessary to detect differences in prey

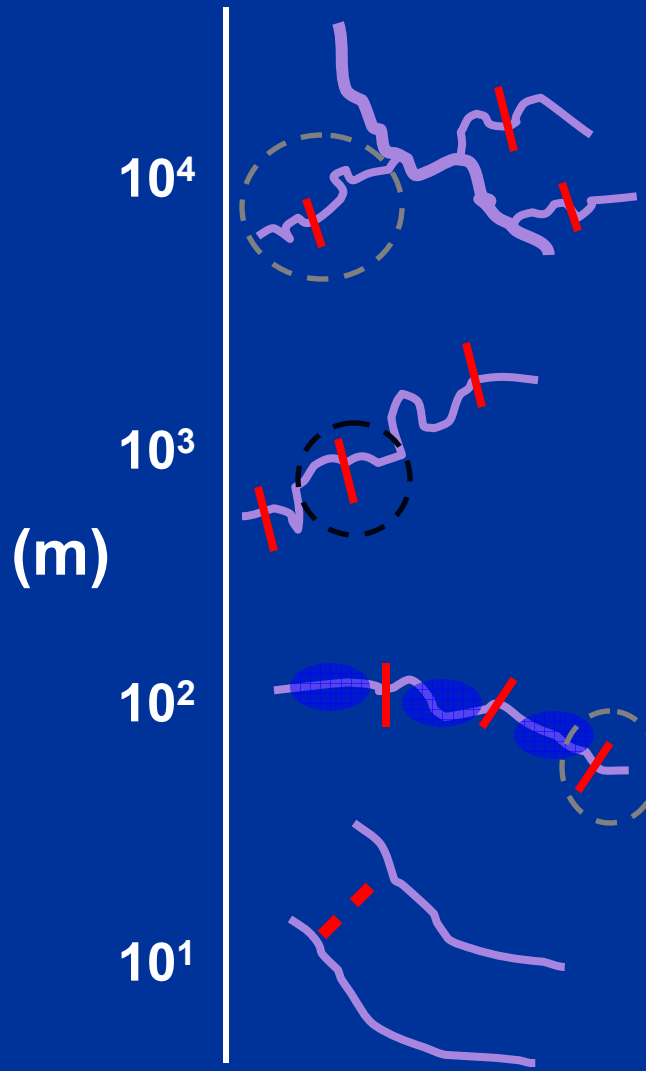
Evaluating Variation

Temporal Scales

Months	Seasonal
Days	Consecutive days
Hours	Diel: am noon pm

Evaluating Variation

Spatial Scales



Sub-basin: 3 streams

Reach: 3 reaches per stream
(1 – 2 km)

Site: 5 pool/riffle sequence
(100-200m)

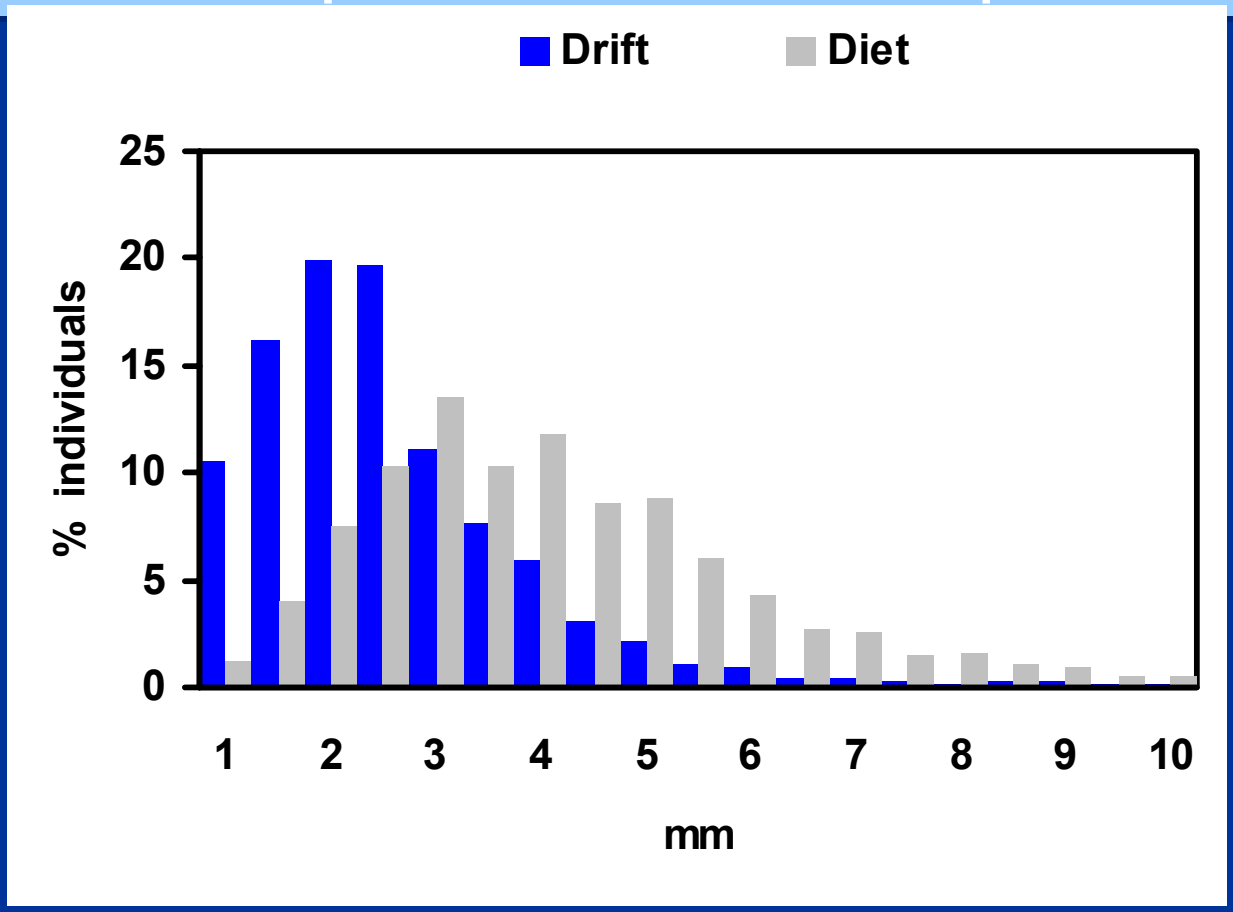
Channel: 2 - 4 replicates

Project Objectives

- Establish a relationship between prey resource metrics and fish production
- Evaluate sources of variability in field sample collection
- **Assess cost-effective yet accurate approaches to sample processing**

Cost Effectiveness

Sample what fish sample



- ↓ 300% process time, < 4% loss in biomass

What about other monitoring programs?

- Can drift be estimated from benthic samples?
  - Compare drift vs. benthic
    - regressions
    - Rader model

ISEMP Objectives

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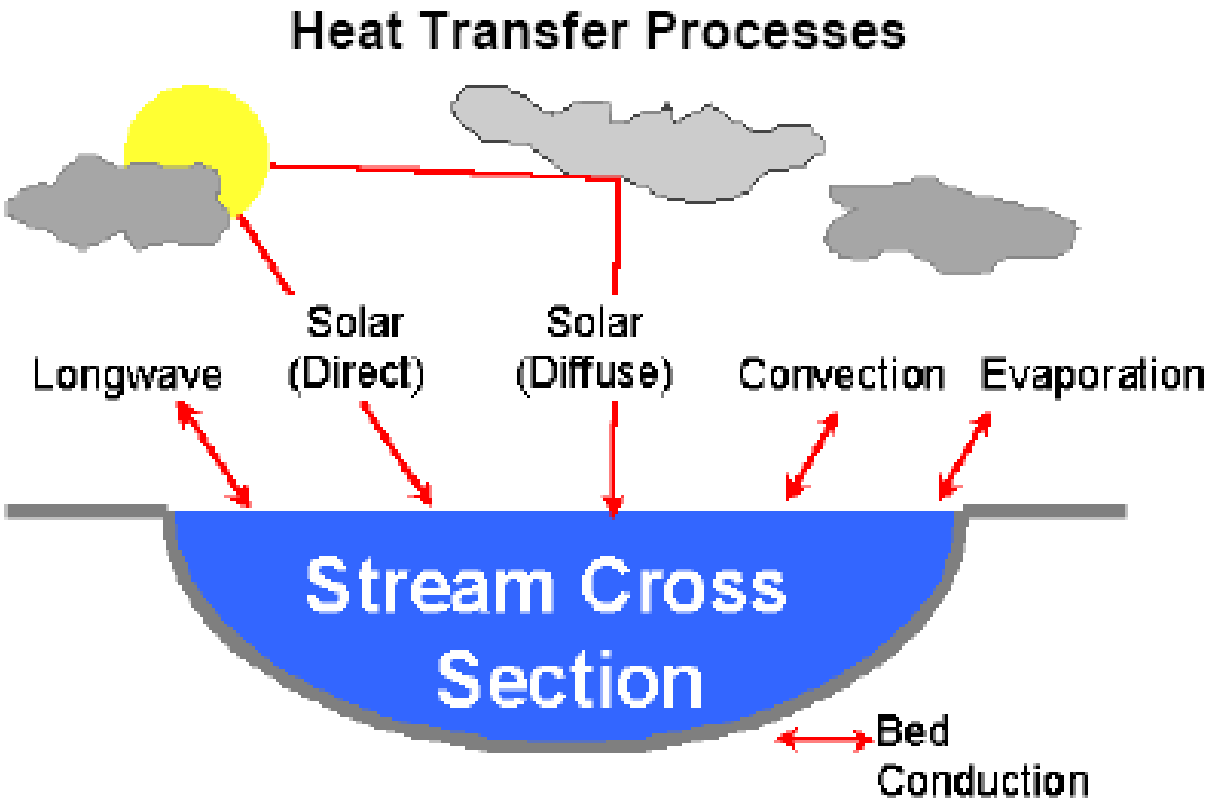
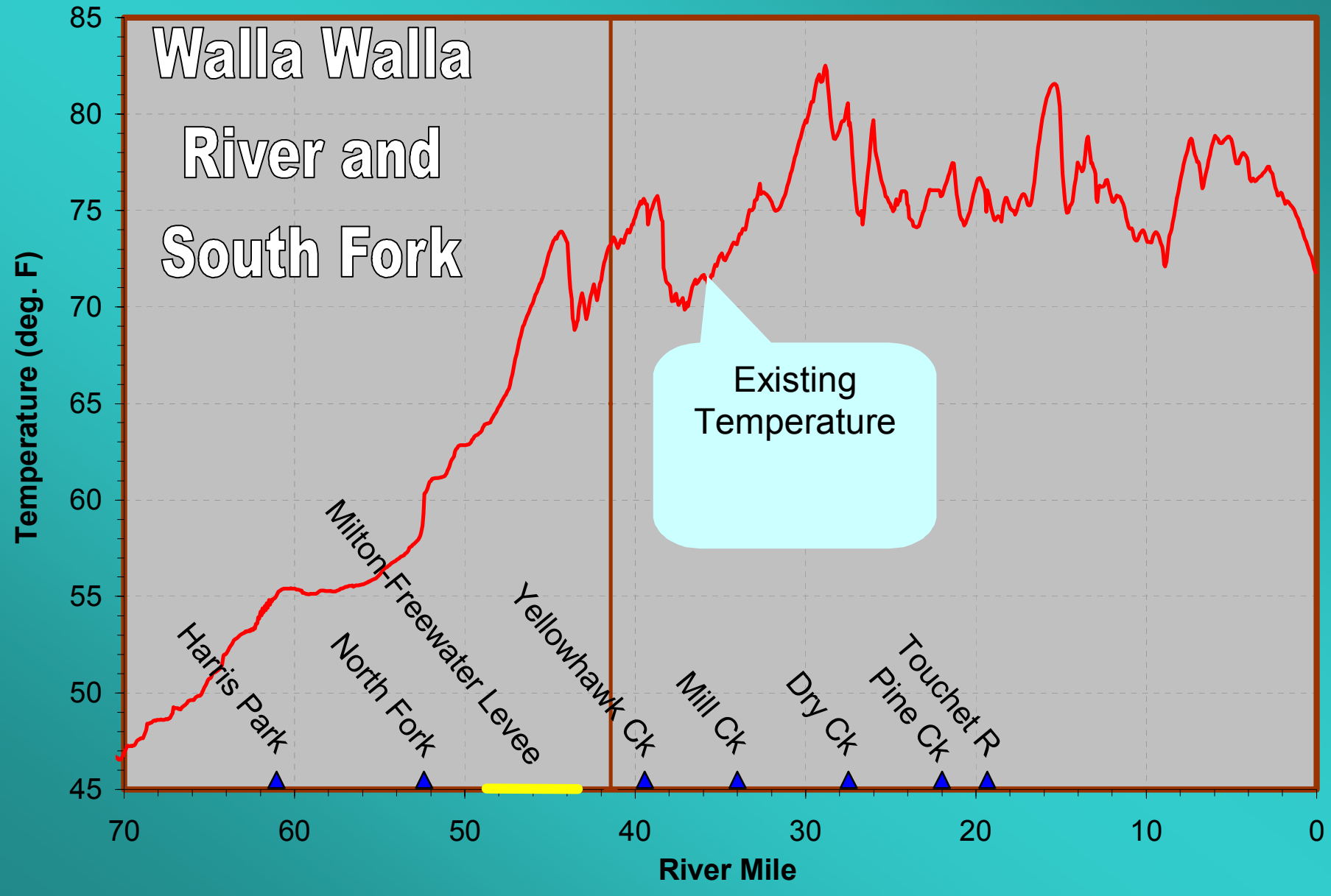
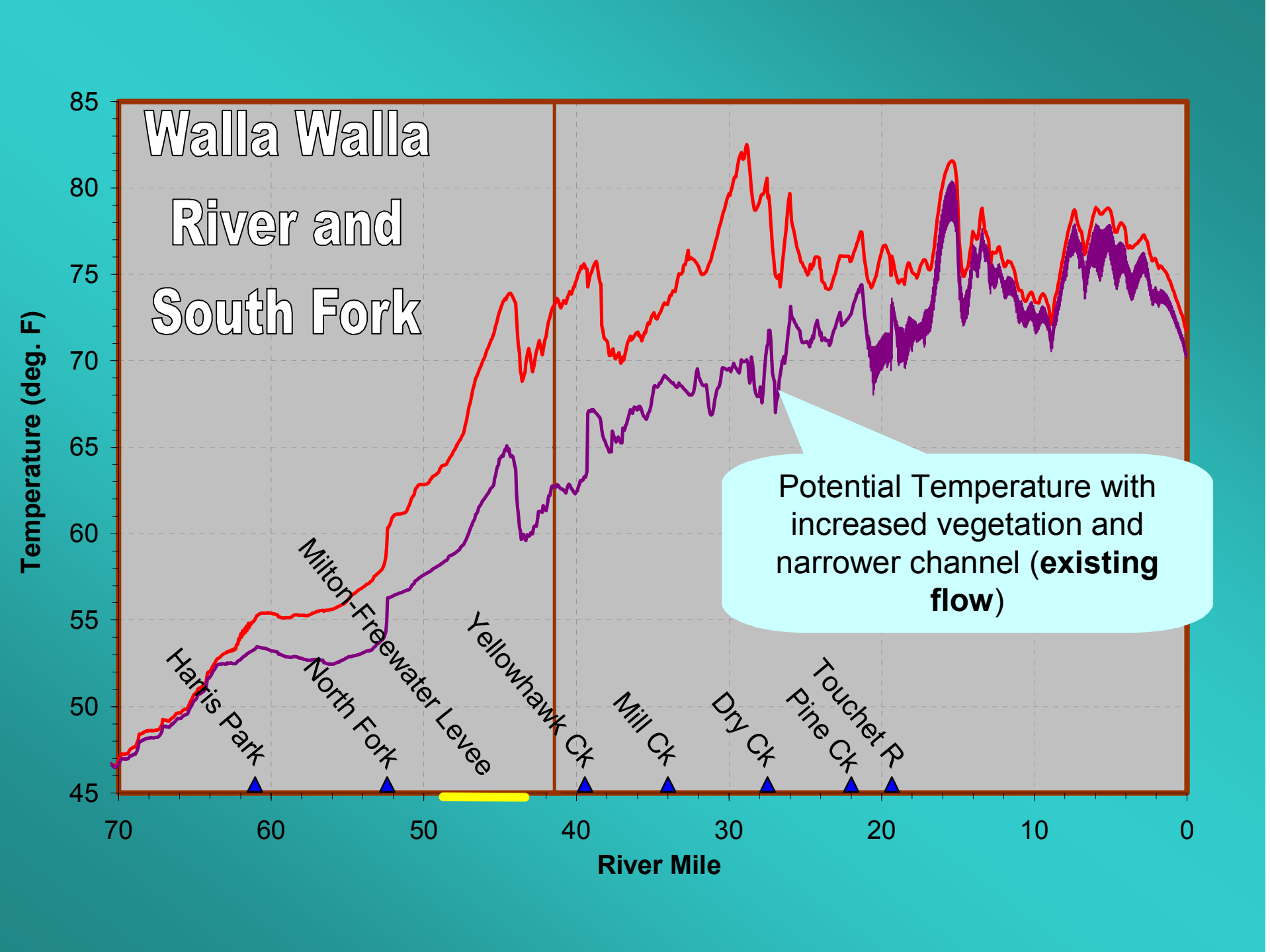
TMDLs – Heat Source Model

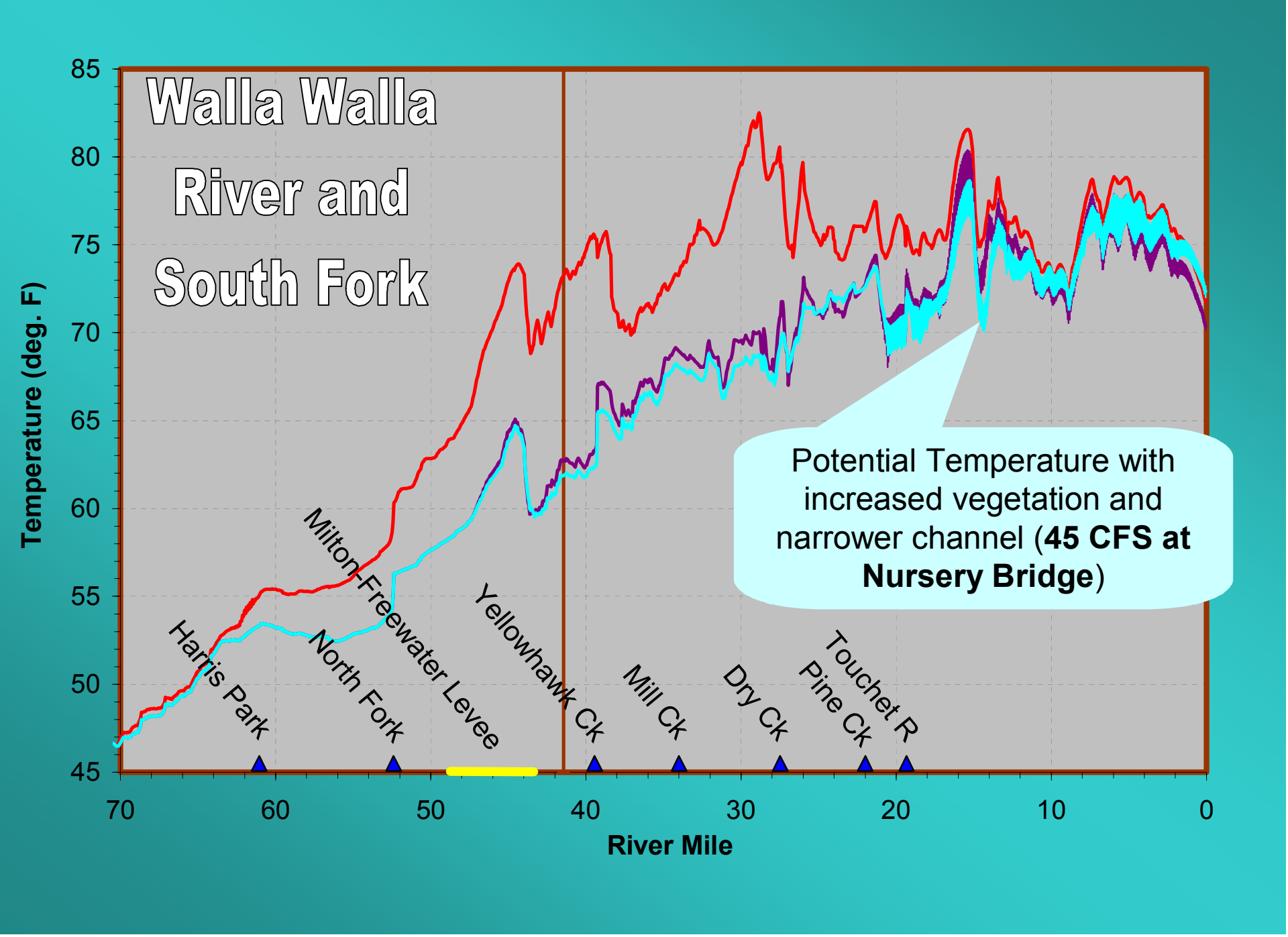


Net Heat Energy Continuity,

$$\Phi_{total} = \Phi_{solar} + \Phi_{longwave} + \Phi_{evaporation} + \Phi_{convection} + \Phi_{streambed}$$


Walla Walla River and South Fork
Existing Temperature
Temperature (deg. F)
85
80
75
70
65
60
55
50
45
70
60
50
40
30
20
10
0
River Mile
Harris Park
North Fork
Milton-Freewater Levee
Yellowhawk Ck
Mill Ck
Dry Ck
Pine Ck
Touchet R


Walla Walla River and South Fork
Temperature (deg. F)
85
80
75
70
65
60
55
50
45
70
60
50
40
30
20
10
0
River Mile
Harris Park
North Fork
Milton-Freewater Levee
Yellowhawk Ck
Mill Ck
Dry Ck
Pine Ck
Touchet R
Potential Temperature with increased vegetation and narrower channel (**existing flow**)


Walla Walla River and South Fork
Temperature (deg. F)
85
80
75
70
65
60
55
50
45
70
60
50
40
30
20
10
0
River Mile
Harris Park
North Fork
Milton-Freewater Levee
Yellowhawk Ck
Mill Ck
Dry Ck
Pine Ck
Touchet R
Potential Temperature with increased vegetation and narrower channel (**45 CFS at Nursery Bridge**)

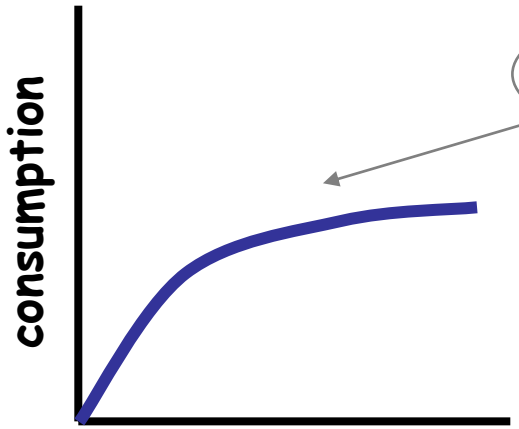
Habitat Surveys

LiDAR
FLIR

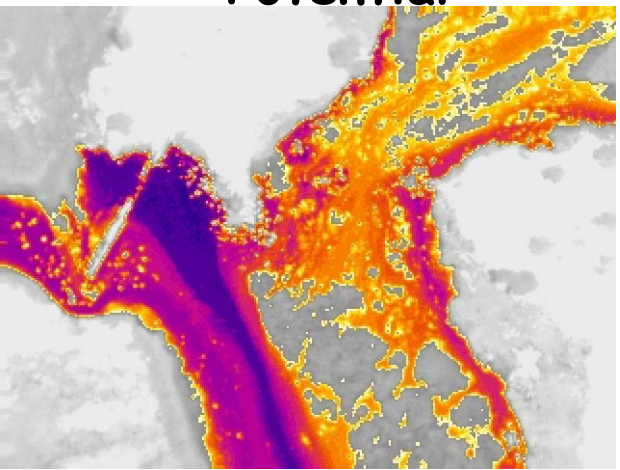
Temperature Model
(Heat Source)

Temperature

Total Invertebrate
biovolume



Map Growth
Potential



Fish Density

Map Production

Summary

- Determine an invertebrate metric that characterizes prey availability
- Develop a cost-effective protocol that can be added to current habitat monitoring programs
- Develop a tool that uses information from current habitat monitoring programs that will:
  - Characterize current habitat status
  - Identify if temperature or food are limiting factors
  - Prioritize restoration sites
  - Describe expected results from restoration

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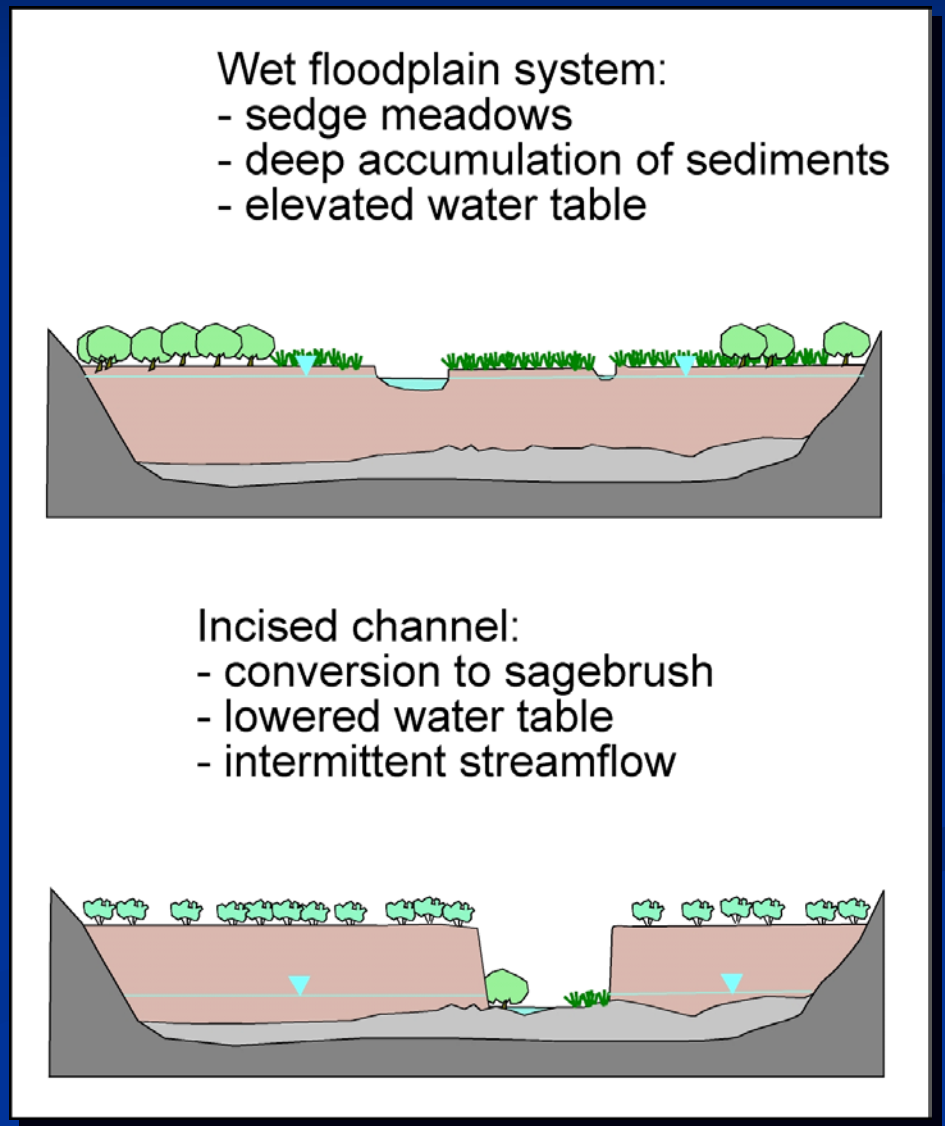
Bridge Creek IMW

- Priority watershed for restoration because of high salmonid production potential
- On 303d list of impaired streams due to poor water quality (e.g. summer temperatures often exceed 27°C)
- Limiting factors include temperature, habitat quality and diversity, sediments and flows

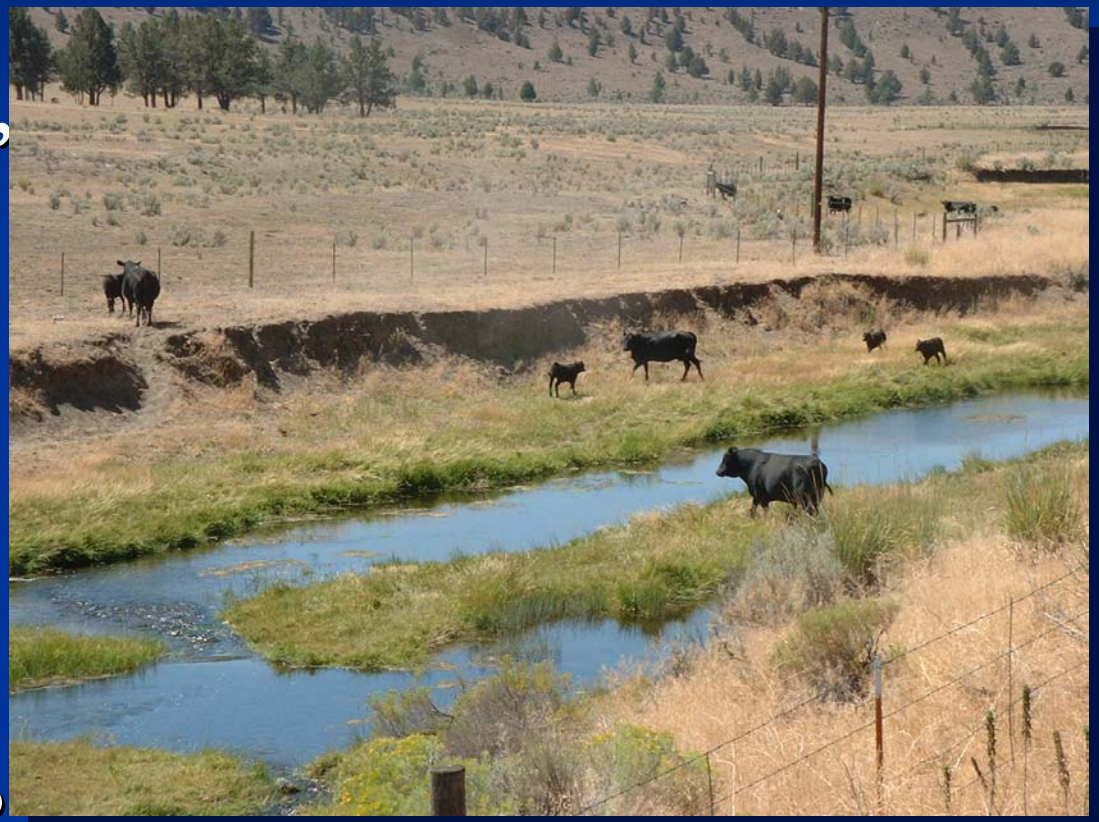
Incision: Rapid downcutting of a channel such that it is isolated from its' floodplain

- Incision effects on habitat and ecosystem processes
  - Loss or riparian and floodplain habitat
  - Disconnect stream from floodplain habitats
  - Lowering of water tables
  - Flood flow concentration
  - Loss of perennial flow
  - Increase temperatures
  - Loss of spawning gravels
  - Decreased spawning and rearing capacity

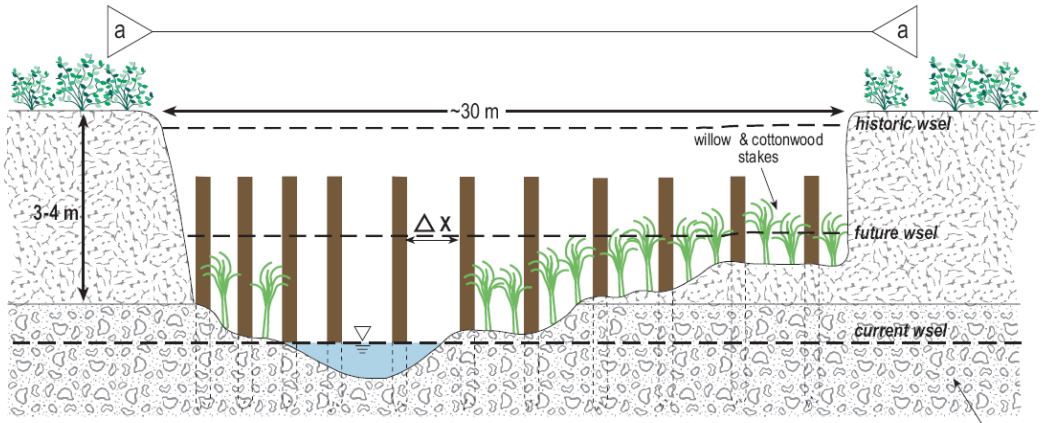


Can incised streams be restored?

- Is the restoration action feasible?
- What does a "restored" stream look like?
- Will ecosystem processes be restored?
- Will the restoration action result in a population increase in freshwater production?
- How long will it take?



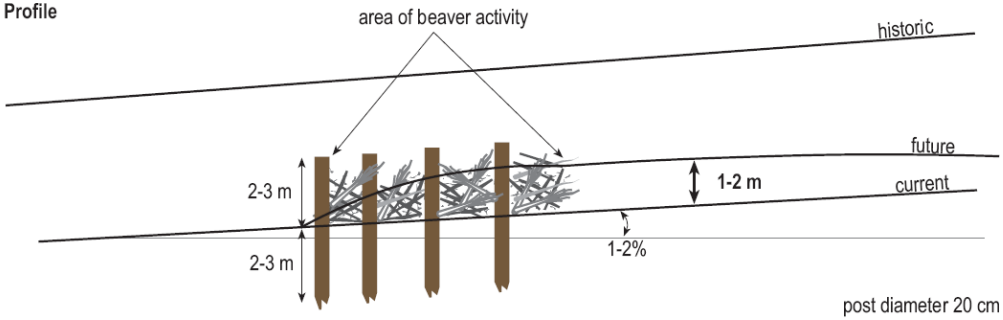
Cross-section



△X = 1.5 - 3 m

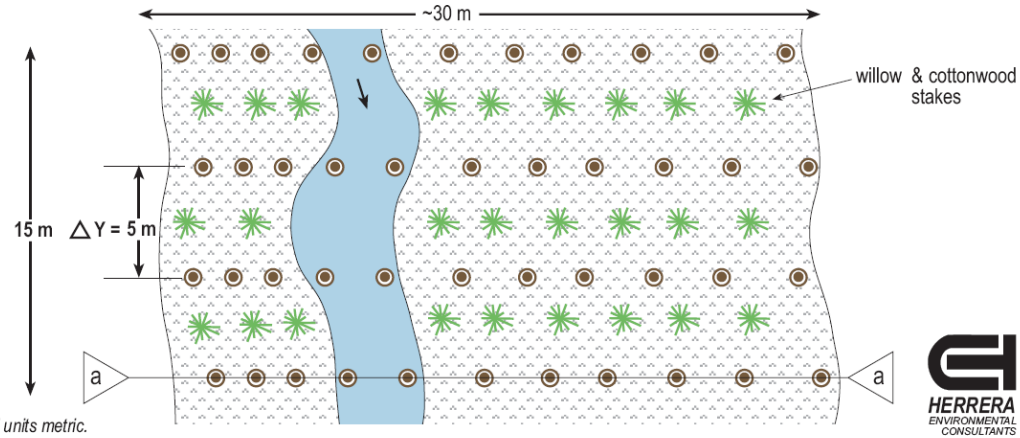
wsel- water surface elevation

Profile



post diameter 20 cm

Plan View

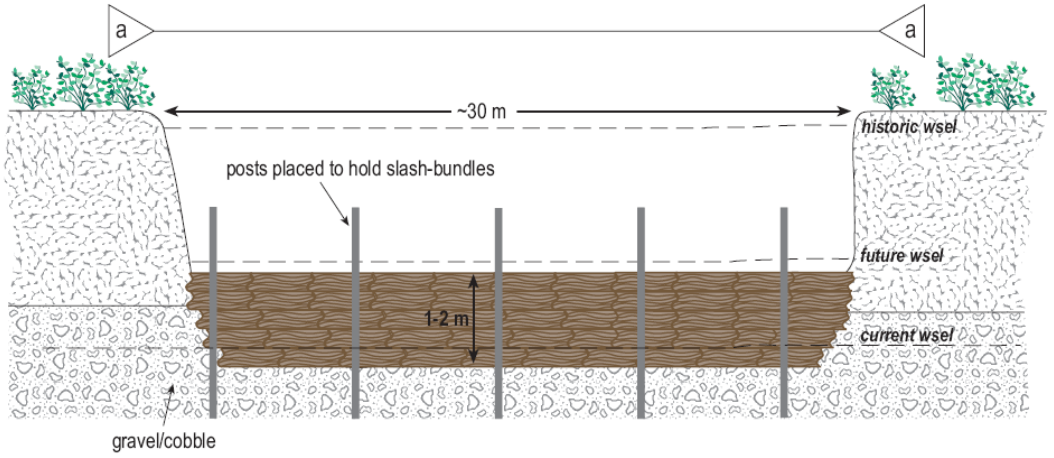


Note: All units metric.

HERRERA ENVIRONMENTAL CONSULTANTS

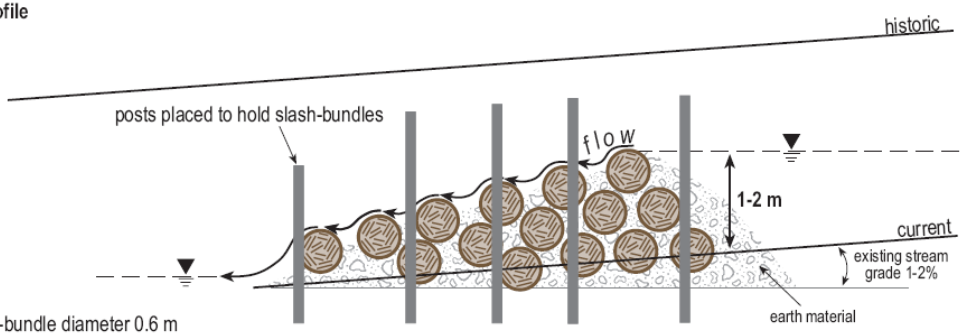
01-08-06/MxHEC-2/P05-0329-000/bproject

Cross-section



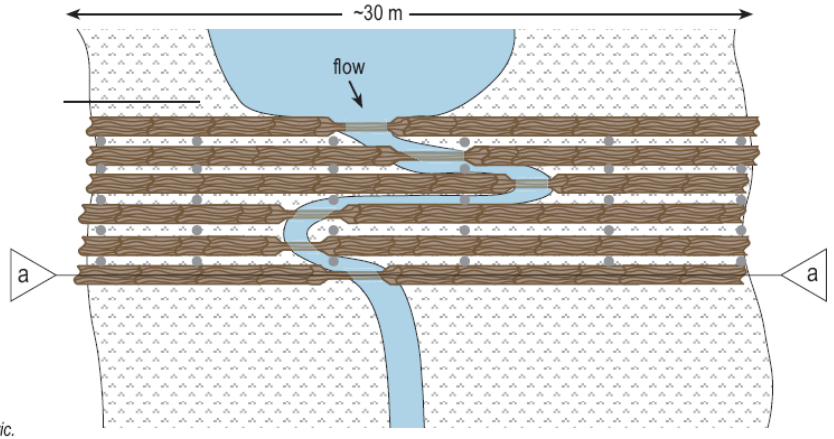
wsel- water surface elevation

Profile



slash-bundle diameter 0.6 m

Plan View

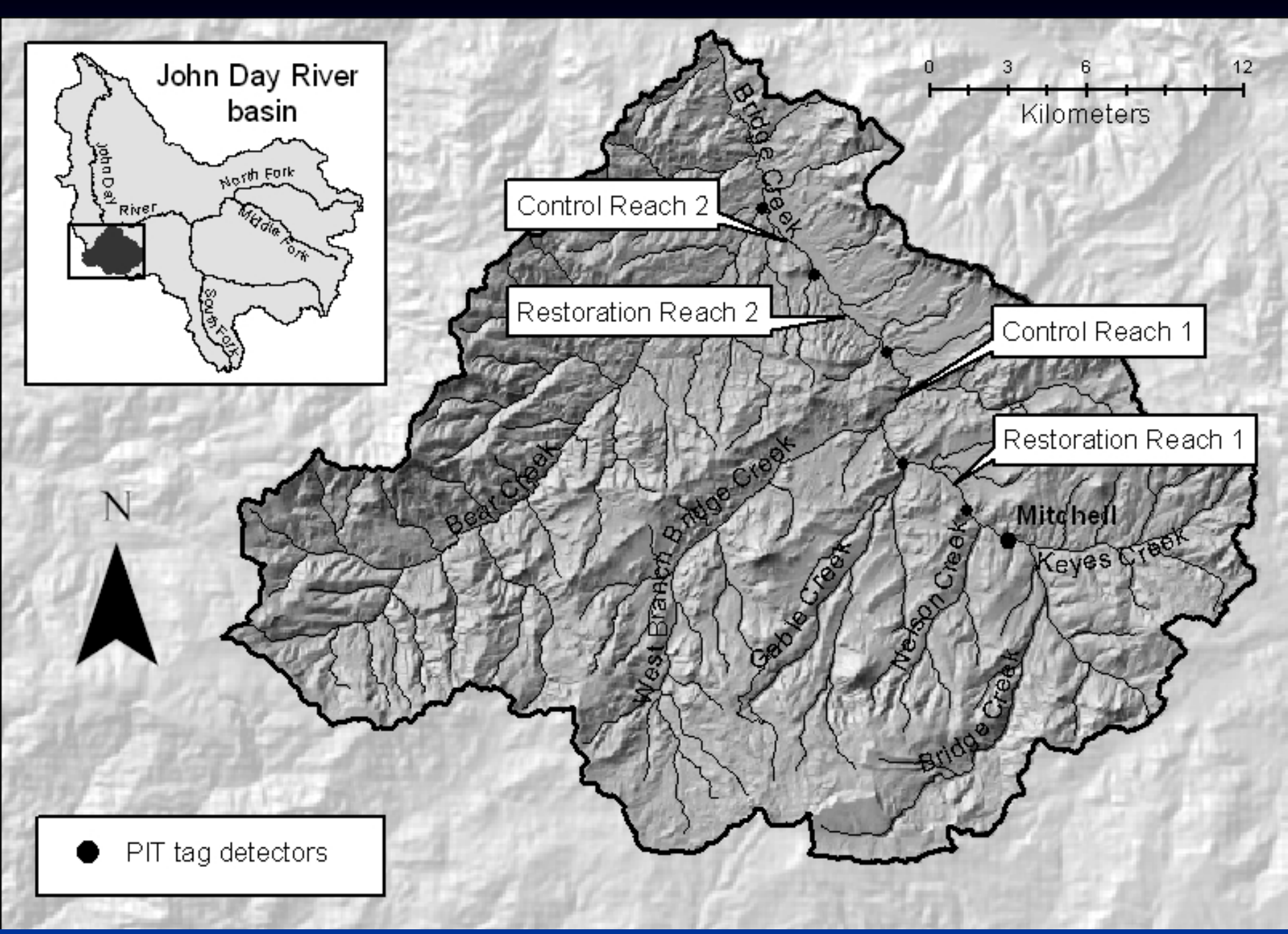


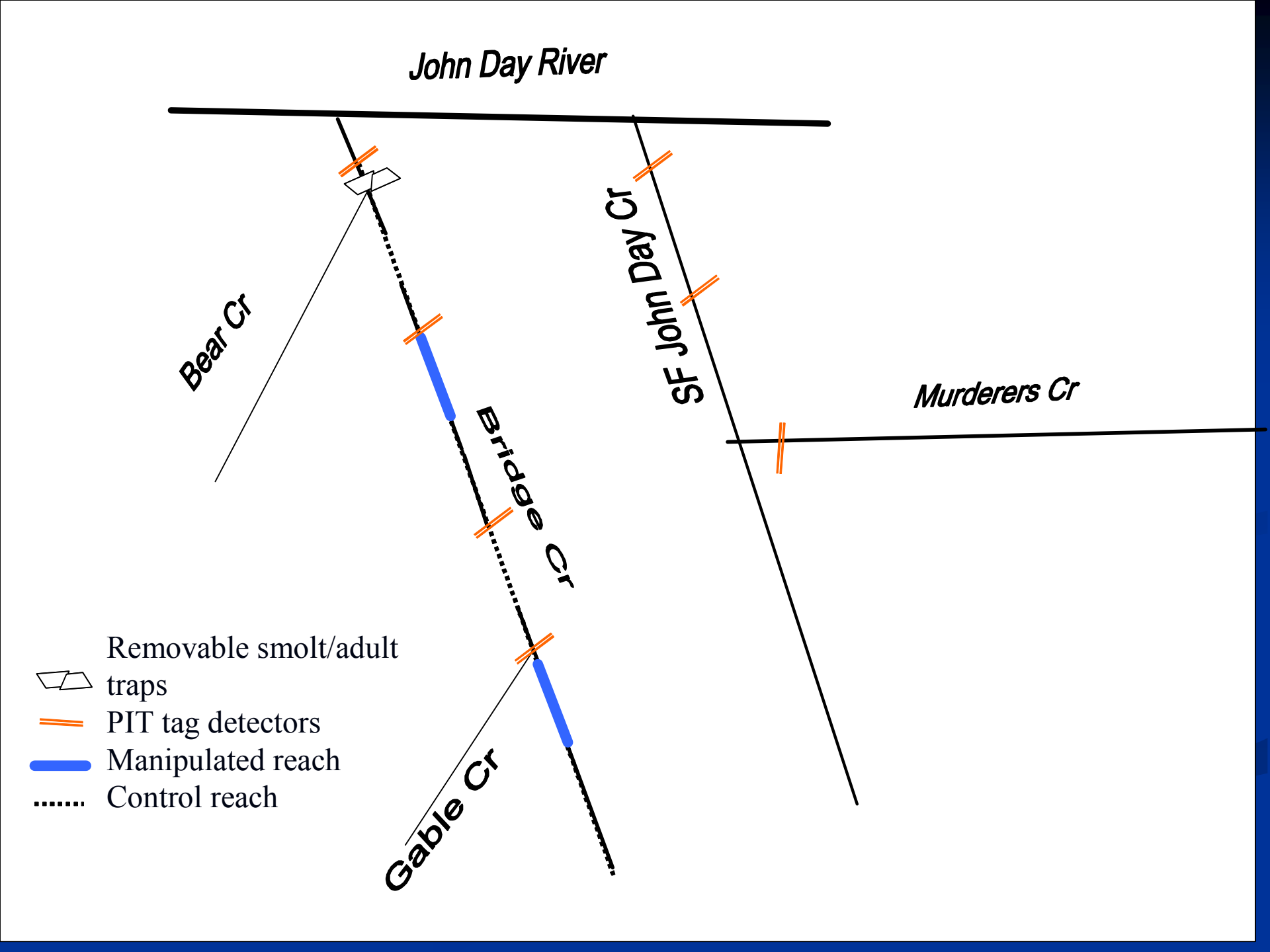
Note: All units metric.

HERRERA ENVIRONMENTAL CONSULTANTS

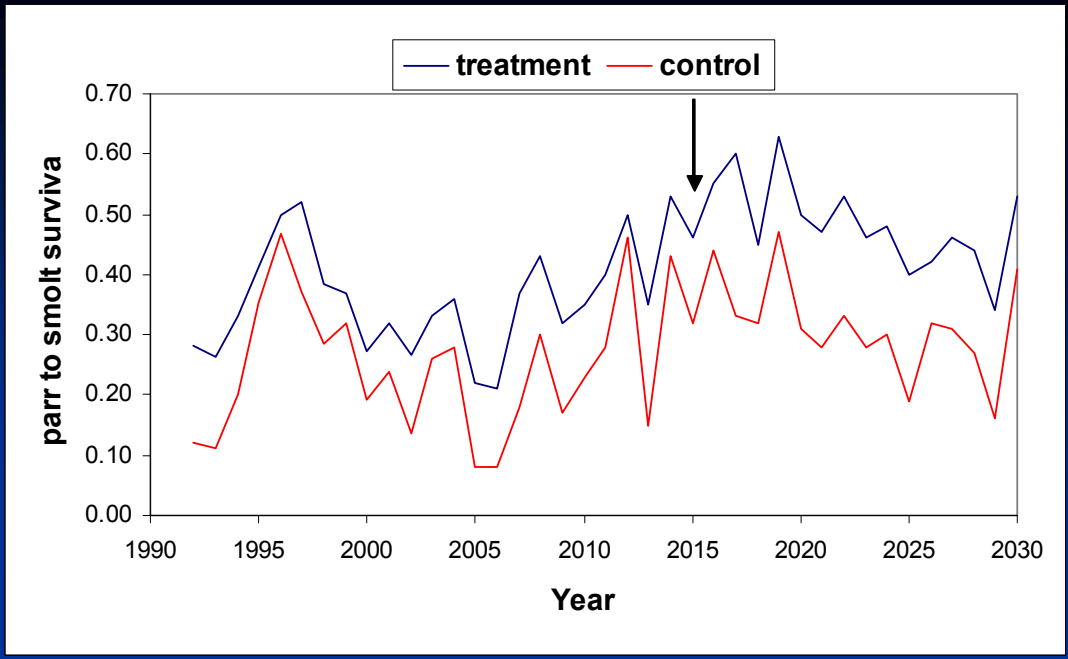
Expected response of *O. mykiss*

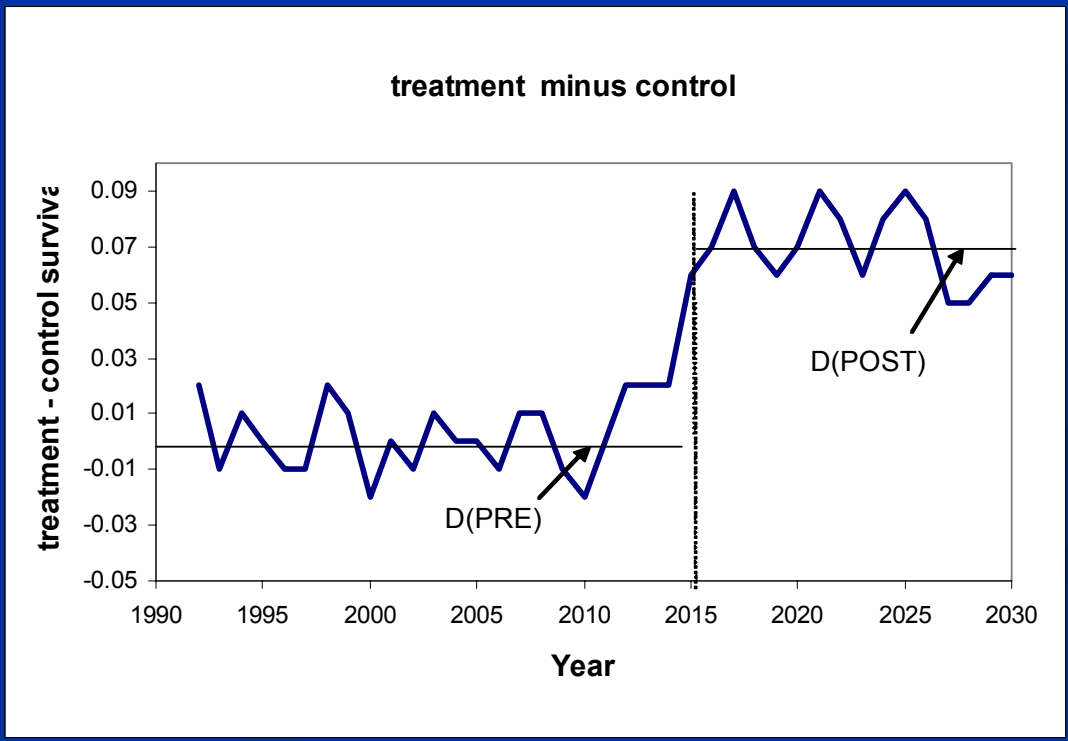
- Decrease temperature will increase growth, condition
- Increase in riparian vegetation and decrease in sedimentation will increase invertebrate production and increase fish growth and density
- Increase habitat diversity will reduce predation and susceptibility to floods
- Increase spawning gravels will increase egg survival


John Day River basin
John Day River
North Fork
Middle Fork
South Fork
0
3
6
12
Kilometers
Control Reach 2
Restoration Reach 2
Control Reach 1
Restoration Reach 1
Bridge Creek
Bear Creek
West Branch Bridge Creek
Gable Creek
Nelson Creek
Bridge Creek
Mitchell
Keyes Creek
N
PIT tag detectors


John Day River
Bear Cr
Bridge Cr
SF John Day Cr
Murderers Cr
Gable Cr
Removable smolt/adult traps
PIT tag detectors
Manipulated reach
Control reach

Intervention Analysis





Summary

- Using ecological mechanisms to develop relevant metrics to be incorporated into monitored programs
- Testing and refining protocols to produce precise and accurate information
- Developing analytical tools to:
  - Characterize current habitat status
  - Identify limiting factors
  - To aid in restoration planning
  - Describe expected results from restoration
- Testing restoration in an experimental management framework- IMWa
  - Produce quantifiable population level response
  - Identify mechanistic relationships to aid in extrapolating results to less intensively monitored areas